WaterAid/ Al-Emran

Faecal Sludge Management Landscape in South Asia

Case Studies

2019

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Cover: Locally made turner in use to maintain proper temperature and quality of compost in Sakhipur co-compost plant in Tangail, Bangladesh.

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1. Introduction

Some cities in the South Asian countries of Bangladesh, India and Nepal have established interventions around faecal sludge management (FSM). The purpose of this study is to identify and disseminate best practices[1] and lessons learned on how to make FSM an integral part of urban sanitation service delivery in cities and towns in South Asia both with and without sewerage systems. This study draws on a literature review from secondary sources, stakeholder consultations and expert interviews in the respective cities/countries[2]. The cities (Table 1) were selected based on population (small and medium), existence of a functioning FSM initiative and ease of data/information availability and collection. The study was designed to present a variety of technology choices or planning approaches covering the whole sanitation chain.

In Bangladesh, the Sakhipur faecal sludge treatment plant (FSTP) demonstrates an efficient and effective model for FSM for small/medium towns, with limited or no-sewerage network. The FSTP in Lakshmipur, Bangladesh is an example of a federal government initiative still being used and run by the municipality. The choice of planted sludge drying beds was based on low maintenance, low resource needs and local context. Greater Warangal Municipal Corporation (GWMC) is the first city in India to introduce FSM regulations and implement city wide interventions to operationalise these. The city is testing two new technologies, a thermal-based treatment plant and geobags, with the aim of scaling up. In Gulariya, Nepal, the FSM project enhanced sanitation coverage through on-call desludging services and demonstrated a faecal sludge treatment plant aimed at sustaining the towns open defecation free (ODF) status which is now solely in the hands of the municipality.

This report serves as a supplement to a more detailed report looking also at the enabling environment in which these technologies and service interventions were introduced. The main report contains the following case studies in a more condensed version as part of that wider narrative. In this supplement, the experiences of the four cities are presented under a consistent structure: an introduction to the context; information

[1] Refers to a package of experiences that has made the intervention successful (beyond only technical solutions)

[2] Annexure 4: Stakeholder Consultation – Bangladesh, Annexure 5: Stakeholders Met – India and Nepal

about the initiation of the project and the planning process; a description of the institutional set up, including where responsibilities lie for various aspects of FSM; details of the interventions split by the different elements of the sanitation value chain; an explanation of any financial or business model used; a list of successes and lessons learnt from the process; and finally, a brief discussion of any remaining challenges. The report ends with a comparative analysis to draw out common successes and challenges and to tie together key findings from across the region.

City	Country	Population
Sakhipur	Bangladesh	40,000
Lakshmipur	Bangladesh	1,50,154
Warangal	India	8,10,000
Gulariya	Nepal	66,679

TABLE 1: Study cities

2. Sakhipur, Bangladesh

2.1. CONTEXT

Sakhipur has a population of approximately 40,000 (2018 figure)[3] and is a rapidly urbanising municipality in Bangladesh. There is currently insufficient solid waste and faecal sludge management resulting in a considerable amount of solid waste which has accumulated over time in and around the city. Onsite sanitation technologies mostly comprise of a septic tank and a variety of pit toilets. Sakhipur does not have a dedicated sewerage system. Instead when the pit or septic tank is full, professional sweepers are employed to mechanically empty them, often meaning that in the past, the sludge ended up in in low-lying surface water bodes like small ponds, pits or drains. Since 2016, some of this collected waste is used for co-composting.

MAP 1: Sakhipur Upazila (Sub-district), Bangladesh

2.2. INITIATION AND PLANNING PROCESS

During 2012-13, a decentralised wastewater treatment system in Sakhipur and concurrently a faecal sludge management (FSM) action research project by WaterAid and Practical Action piloted various treatment and composting mechanisms for faecal sludge in Faridpur Municipality. These experiences gave confidence to the Mayor of Sakhipur to build a faecal sludge treatment plant in the municipality to address the mounting waste problem and a formal participatory planning process was then carried out in Sakhipur. The municipality, or Pourashava, was responsible for the initiation and development of the process, with technical assistance from WaterAid Bangladesh and Bangladesh Association for Social Advancement (BASA).

[3] Source: Sakhipur Municipality

WaterAid/ Sujaya Rathi

FIGURE 1: Sakhipur co-composting plant

A baseline study was conducted to provide detailed information on waste generation (faecal sludge, solid waste and poultry litter) including volume and collection, disposal, and treatment options. A Shit Flow Diagram (SFD) by WaterAid Bangladesh[4] showed that 0% of faecal sludge generated in Sakhipur was safely managed. Representatives of the municipal authority also conducted learning visits to Faridpur, Meherpur and Kushtia to find appropriate options for Sakhipur.

Following the SFD, it was decided through a participatory process (including local government, NGO representatives, the local community and all other stakeholders) to construct a co-composting plant for faecal sludge and organic solid waste to address the lack of services (PMID, 2015). There were several consultation meetings between the Pourashava, WaterAid and BASA, which included a joint planning workshop, several focus group discussions, and open discussions with citizens, before finalisation of plant construction. The planning process was gender sensitive with women represented in decision-making. The commitment was ensured through the leasing of 0.3 acres of land for the co-composting plant by the Pourashava authority in the outskirts of the municipal area. As the Pourashava leased the land, no settlement issues were involved. The municipality also supplied a Vacutug.

[4] A shit flow diagram is a tool to help understand and communicate how excreta physically flows through a city. See Annexure 1: Sakhipur SFD

WaterAid/ Sujaya Rathi

A constructed wetland and sludge drying beds in Sakhipur co-compost plant, Tangail, Bangladesh

Some of the key considerations while planning and designing the co-composting plant were:

- Consideration of scale: Initially the Vacutug was accessible to only 20% of households and so a plan was made to increase accessibility and the capacity of the plant was designed to increase over time.
- Use of a simple, known technology not requiring highly skilled operators: The design was one that the Mayor knew and had confidence in. Energy use for operation was also required to be low.
- The technology should integrate waste management and produce useable end products especially given that Sakhipur is a vegetable growing area.
- Occupational health and safety measures.
- Quality assurance: The design should ensure that the expected quality of compost is produced during operation. To ensure this, a trial period was carried out.
- Cost considerations: A willingness to pay survey showed that about 40% of the households in the municipality were willing to pay between BDT 1 to 200 per month for faecal sludge management services[5].
- Special consideration of service charge for poor households whereby they pay only for the fuel.

[5] Refers to a package of experiences that has made the intervention successful (beyond only technical solutions)

The planning process was robust, with consideration of all elements of the sanitation chain.

2.3. INSTITUTIONAL SET UP

The municipal authority played a significant role in realising their need for FSM and working closely with WaterAid Bangladesh and its partner BASA. WaterAid provided technical and financial support (particularly linked to plant construction and part of the operation and maintenance) and BASA worked as the implementation partner. The municipality carries out supervision of the collection of faecal sludge, conservancy, billing and tariffs. A management committee was formed to oversee the operation and maintenance (O&M) of the plant which included the mayor as the advisor and members from municipality, BASA and professional representatives. O&M is currently managed jointly by the Municipality and WaterAid: the municipality employ the staff who are supported by a WaterAid engineer and WaterAid contributes financially to some of the replacement materials required.

SAKHIPUR TREATMENT PLANT – QUICK FACTS (Nath, et. al., 2017)

De-sludging period assumed: 2 years

Sludge drying: 10 x 9m^2 unplanted drying beds with a loading capacity of 8,000 litres per day of sludge at a loading depth of about 20cm. It takes three to five trips to fill one bed, where faecal sludge is kept for 14 days and refilled in cycles.

Liquid waste treatment: Constructed wetland with hybrid flow followed by polishing pond.

Co-composting: Aerobic decomposition of dried faecal sludge and organic solid waste. The organic solid waste, dried faecal sludge and sawdust are mixed at a bulk volume ratio of 3:1:1.

Current operations (annual): About 1,500 tonnes of faecal sludge and about 150 tonnes of solid waste are treated to produce 24 tonnes of compost in a year.

Coverage 2017: Increased proportion of faecal sludge produced that is safely managed from 0% to 43%

2.4. INTERVENTIONS AND TECHNOLOGY

Emptying and Transportation: Desludging is currently an on-demand service. When any householder needs their latrine emptying, they make an application and pay a collection fee at the Municipality office. They are then added to the schedule for the 1,000-litre capacity Vacutug owned by the Pourashava. This service is in operation 4 days a week collecting 16,000-20,000 litres of sludge each week. Currently, door-to-door solid waste collection (needed for co-composting) is operated by an individual entrepreneur for a monthly fee and the segregated organic waste is supplied to the co-composting plant. Poor households only pay the fuel costs.

The Treatment Plant (Figure 1): Action research led to a decision to use an unplanted drying bed constructed with locally available technology. The co-composting plant in Sakhipur became operational in January 2016 starting with a six-month trial operation to ensure the quality of the end product. The design capacity of the plant was such that all faecal sludge collected would be treated and the required proportion of solid waste will be used for co-composting within the available land constraints. Occupational safety and health measures are observed and follow the guidelines prepared for the Government of Bangladesh and FSM sector actors (Bangladesh Institute of Labour Studies, 2015).

Reuse: Farmers are using the compost as a soil conditioner and their feedback is encouraging. The Department of Agricultural Extension of the Sakhipur municipality has been providing further technical guidance for reuse and is distributing the compost among local farmers. However, there is still a social stigma and unacceptance of new approaches around faeces and their reuse.

2.5. FINANCIAL AND BUSINESS MODEL

Plant construction was financed by WaterAid Bangladesh and did not use any public funds. WaterAid also provided technical assistance. Resources provided by the municipality include the approach road, land and desludging vehicle. They also collect the tariffs for desludging services. An account operated by the municipality manages the fees collected from sludge and solid waste collection and the sale of compost. Currently the operation and maintenance of the plant is managed jointly by the Municipality and WaterAid. The Vacutug O&M and salary of 2 staff are provided by municipality, paid out of the account. The sorting of the solid waste is the costliest activity contributing to approximately 30% of the total O&M cost. In the first year, the O&M expenditure was USD 20,621 against an income of USD 13,051 (Al-Muyeed, et. al., 2017). It is estimated that an income of around USD 7,000 will come from solid and liquid waste collection tariffs and approximately USD 6,000 from selling the compost. Since January 2019 door-to-door solid waste collection has been done by a private entrepreneur who supplies segregated organic waste to the plant meaning that the sorting cost is borne by the entrepreneur. It is yet to be seen if this new model will make the plant financial sustainable.

QUICK FACTS (Nath, et. al., 2017)

De-sludging Tariff: USD 10 per trip

Solid Waste Collection: Monthly fee of USD 0.40

Compost sold by the municipality to farmers: USD 0.20 per kg

2.6. SUCCESSES AND LESSONS LEARNT

The co-composting plant in Sakhipur provides evidence and learning on FSM in the context of Bangladesh, especially for small municipalities with limited resources with respect to i) technology, ii) process, iii) estimate of resource needs, iv) reuse potential, v) socio-economic aspects of co-composting, vi) identification of the impacts of using the compost on crops and soil, and vii) raising awareness and knowledge about co-composting as a waste recycling option. It has enhanced visibility of faecal sludge and solid waste solutions in a country like Bangladesh, including through a visit from the Prime Minister's office. Some specific areas of learning are given below.

Political commitment: The technology which included co-composting of faecal sludge and solid waste meant that the waste challenge could be addressed in an integrated manner. This helped gain political support, commitment and ownership demonstrated through the provision of land.

De-risking decisions: Demonstration projects and FSM action research in Bangladesh had shown that sludge drying technologies can be successful, thus reducing the risk involved in the technology selection.

Evidence created through the baseline study and SFD helped show the urgency of the waste situation in the municipality. Advocacy guided by BASA and WaterAid, and based on this evidence, then built momentum at the grassroots level in turn empowering the municipality. Participatory methods like face-to-face interactions, focus group discussions and media (print and audio) were used to communicate the need for, and availability of, services. This contributed to creating demand for services which in turn informed the parameters for the technology design.

Institutional commitment: Representatives of all key stakeholders formed a committee with the mayor as its advisor to carry out the process of implementation and service delivery.

Reuse: The technology chosen was a proven technology that addressed the full sanitation chain including the reuse of the treated sludge in agriculture. The agriculture school was engaged to educate and mobilise the farmers and ensure proper use of the compost.

Quality assurance: The 6-month trial period helped establish confidence in the technology and its end products. Continuous performance monitoring is carried out periodically from government laboratories.

Scope for scaling up: Planning and implementation was done in phases and the technology chosen was such that it could be constructed in a modular fashion, opening more drying beds as coverage increased.

WaterAid/ Al-Emran

A worker holding 'Sakhi Compost'- the end product produced at the Sakhipur co-compost plant, Tangail, Bangladesh

2.7. REMAINING CHALLENGES

Demand Creation: Convincing people to use a new service is difficult, although continuous advocacy is being done by BASA and the municipality.

Collection: Vacutugs cannot access many areas in the municipality, especially slums, though manual emptying exists. The services are also limited by the volume of one Vacutug.

Treatment: The land provided by the city helped to reduce transaction costs and bureaucratic delays. However, the plant is located quite far from the city which contributes to higher transport costs, thus impacting the financial viability. Also, demand for collection and transport services is highest during the rainy season as heavy rainfalls result in overflowing of on-site systems. Consequently, the volume of dry sludge is reduced which has implications for the composting operation, and thus end product quality and income generation.

Reuse: The social stigma and unacceptance of unfamiliar approaches around faeces and their reuse still needs to be addressed. This hesitation impacts distribution and use of the compost, and thus income generation.

Sustainability: The capital cost was covered by WaterAid Bangladesh and the plant is recovering about 70% of the cost with respect to O&M operations. The ability of the municipality to sustain services after WaterAid exits also remains a challenge.

3. Lakshmipur, Bangladesh[6]

3.1. CONTEXT

Lakshmipur has a population of 150,154 (2018 figure)[7]. The predominant on-site sanitation systems are pour-flush latrines with direct and off-site pits (60%) and toilets connected to septic tanks with or without soakage pits (35%). The design of septic tanks and pit latrines has often not considered their users and/or standard design practice which affects septic tank treatment performance and effluent quality. Discussion with Pourashava officials revealed that sanitation facilities are only checked in buildings over 5-stories high (very few in Lakshmipur) and there are not enough personnel to do this thoroughly. People usually desludge their septic tanks/pits when they overflow though some also reported desludging at fixed regular intervals (Rahman, et. al., 2015). Sludge is also disposed of in drains, dug holes, or open land without any treatment. There are limited arrangements for centralised sludge collection, treatment and disposal (FSM Network, 2016).

3.2. INITIATION AND PLANNING PROCESS

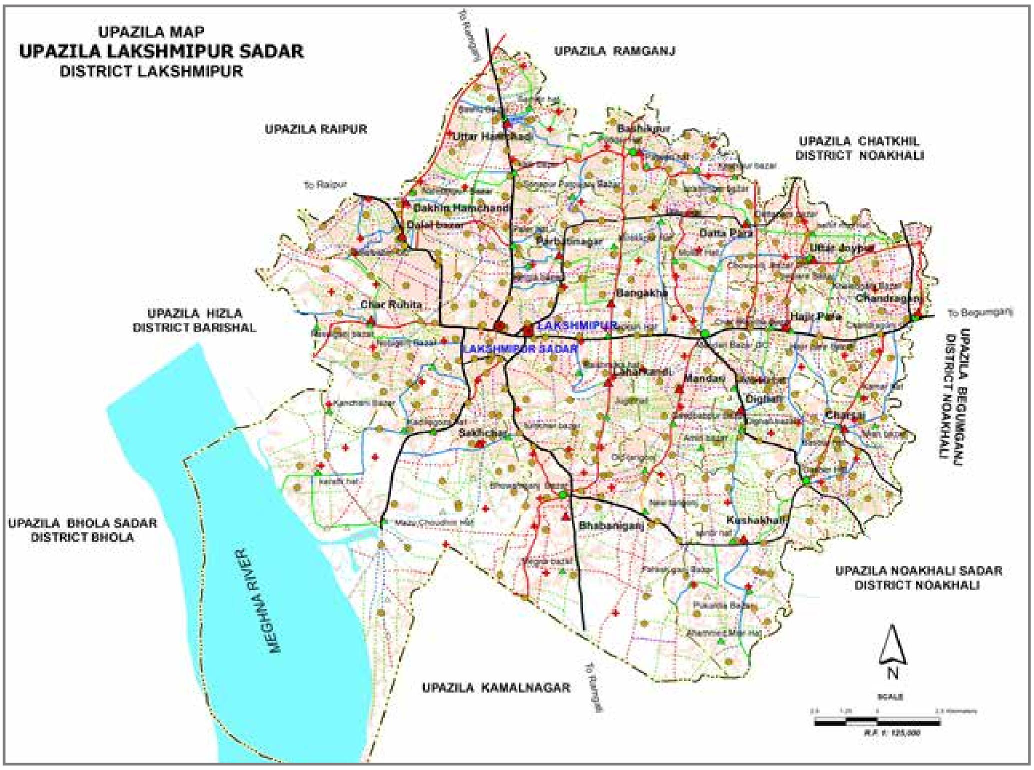
The first initiative to implement FSM in Bangladesh was under the Secondary Towns Water Supply and Sanitation Sector Project (STWSSP) from 2006 to 2014, executed by the Department of Public Health Engineering (DPHE). The Asian Development Bank (ADB) approved the STWSSP with co-financing from the OPEC Fund for International Development (OFID). From the 16 project municipalities, or Pourashavas, Lakshmipur showed strong political will to implement an improved FSM system. The commitment of the Mayor of Lakshmipur Pourashava played a vital role in successfully building a faecal sludge treatment plant (FSTP) under the Government of Bangladesh and ADB funded project. The FSTP was established during Phase 2 of the project with a trial run in December 2012. The plant was set up by DPHE and handed over to the Pourashava after construction in 2014.

Based on secondary reports[8], key considerations for planning and designing were:

[6] Availability of secondary information was limited

[7] Source: Pourashava

[8] No baseline planning study could be made available by the DPHE during the course of this research so the planning process is not very clear.



MAP 2: Lakshmipur Upazila (Sub-district), Bangladesh

- Elimination of dumping of septic tank sludge into the environment
- Low cost and locally available technology
- The treatment plant should be simple to maintain
- Improvement of public health
- Size of land available
- Minimum external energy usage
- Enhancing solids retention in septic tank to reduce accumulation of solids in the drainage system
- Potential in the future for producing dewatered sludge that could be used as manure in agriculture

During the project there was an advocacy campaign to encourage people to desludge which was run by the Pourashava using audio campaigns and advertisement on local television etc. This helped to popularise the initiative. Evidence of citizen participation was not available, although conversations with the city officials indicated that focus group discussions, consultations and awareness campaigns were carried out during the project phase.

3.3. INSTITUTIONAL SET UP

DPHE was the executing agency and handled overall technical supervision and execution of the project. DPHE established a Project Management Unit (PMU) to provide technical support, manage the day-to-day operations, and coordinate with the Project Implementation Unit (PIU) which coordinated with relevant district level bodies. A water supply and sanitation committee was set up under the Pourashava mayor to oversee the interventions. All development works were discussed at a 50-member citizen forum called Town Level Coordination Committee (TLCC) and implementation progress was also monitored by them. Local female councillors took part in decision making and planning. It is to be noted that these were established and functional only during the project phase.

3.4. INTERVENTIONS AND TECHNOLOGY

Emptying and Transportation: The Pourashava introduced on-demand mechanical desludging service in 2013 using Vacutugs received from the project, and many people used this service. The Vacutugs were designed and fabricated by the local Mirpur Agricultural Workshop and Training School (MAWTS) who also provided training to sweepers, Pourashava staff, and sludge emptiers. When any household needs the desludging service, they pay a collection fee at the Municipality office and get added to the schedule. The Pourashava supervises collection of faecal sludge, conservancy, billing and tariff setting and collection. The coverage of services is very low, operating only twice a week.

The Treatment Plant (Figure 2): A planted sludge drying bed was selected based on an evaluation of different technologies available for sludge drying and the identified requirements.

The choice of planted sludge drying beds over unplanted sludge drying beds was made for following reasons:

- The dried sludge produced from these beds does not require further treatment for its disposal
- High dewatering efficiency with final volume reduction of up to 98%
- De-sludging of beds requirement is limited, hence minimal maintenance
- Reed beds are odour free as the sludge is kept in an aerobic state
- No electricity is required for the plant to operate

FAECAL SLUDGE COLLECTION

- Mechanical desludging since 2013
- Number of Vacutugs- 3
- Collection: around 5,000 litres of sludge daily
- Servicing of Vacutugs once in 3-5 months
- More than 900 septic tanks were emptied by the Pourashava by mid-2018 and the volume of black water was around 4,500 m^3
- Desludging tariff: USD 12.5 per trip (1,000 BDT)
- Collection of USD 125 every week for providing emptying service by the Pourashava
- The operation and maintenance cost is around USD 15 per week

- Efficient chemical and biological contaminants removal (DPHE, 2014)

For the constructed sludge drying bed, plants were selected that were tough, adaptable, able to grow in polluted waters and find sustenance in sludge, had a voracious appetite for water, were tolerant to low oxygen levels and also locally available in Bangladesh.

The liquid effluent generated from the plant is reported to satisfy the national discharge standards and is therefore discharged into the open environment (Rahman, et. al., 2015). However, no evidence to that effect was provided by the Pourashava and there is no data on the quality of compost or dried sludge produced at the treatment plant. At present, there is no active consideration of reuse of the dried sludge.

WaterAid/ Sujaya Rathi

FIGURE 2: Lakshmipur – Desludging Vehicle and Planted Drying Bed

TREATMENT PLANT – QUICK FACTS

Sludge drying

- Conventional sludge drying beds - impermeable beds of gravel, sand and planted vegetation
- Area of treatment plant is 780 m^2 - Two sludge drying beds for alternative use, each bed consisted of 144 m^2 area
- Design life: 5-7 years
- Septic tank emptying interval: 2-3 days per week

Wastewater treatment

- A system of perforated pipes receives water from applied sludge that seeps through layers of sand and gravel into drains and is finally transported to disposal location.

Current Coverage (2018): 20% population

3.5. FINANCIAL AND BUSINESS MODEL

The cost of plant construction and technical assistance was provided by the STWSSP but the operation and maintenance cost is now borne by the Pourashava who also provided the access road and the land for the treatment plant. The Pourashava is responsible for tariff collection and for the desludging services including employment of the Vacutug operators (who also collect solid waste). The service charge collected per week is about USD 125 and USD 18,500 was collected from customers since the beginning of the operation of the plant. The operation and maintenance cost of the Vacutug is stated to be around USD 15 per week[9]: the main cost is the fuel as the plant does not require much maintenance.

The business model for the FSM operations is not developed[10] and there are no plans from the Pourashava to enhance the

[9] Conversation with Engineer, does not take into account depreciation cost, and other servicing costs.

[10] Although the STWSSP had a financial analysis done together with water supply operations for 20 years of operation (not disaggregated).

efficiency and coverage of FSM services and performance of the treatment plant due to lack of external funding[11]. It is difficult to assess the financial sustainability of the model, given the lack of information.

3.6. SUCCESSES AND LESSONS LEARNT

Political will: This is key in gaining momentum for FSM interventions. The Mayor's commitment to the construction of the treatment plant was manifested through providing access and land for the project. Use of a locally available technology and a dispute resolution mechanism were important for maintaining this political buy-in.

Institutional arrangements: The involvement of both DPHE and the Pourashava along with a strong Town Level Coordination Committee to settle disputes helped to coordinate the project and enabled the project to be completed as planned.

Sustainability: The FSM system in Lakshmipur was a federal government initiative and is still being run by the municipality successfully. However, the whole FSM value chain, including use of the end product, must be considered to ensure quality of service delivery and financial sustainability of the treatment system.

Scope for scaling up: The technology selected is appropriate for scaling up but would require enhanced capacity within the municipality for operation and maintenance to ensure city-wide service delivery.

3.7. REMAINING CHALLENGES

Collection of faecal sludge: Lack of access of Vacutugs to difficult areas affects coverage and service levels especially for the poorest.

Availability of spare parts: Spare parts are not available locally for Vacutugs procured during the project[12].

Demand for de-sludging low: Since the project initiation, there has not been any strategic demand creation and convincing people to use the new services has been challenging. The demand is low, with average of one trip/day.

Monitoring: There is currently limited performance monitoring of the plant.

Reuse: This has not been considered yet. Social stigma and habitual unacceptance of new approaches have proven to be a challenge in considering the reuse of dried sludge.

Lack of capacity: Pourashava staff (technical, managerial, financial) do not have the necessary skills to sustain FSM interventions (increase coverage, operation and maintenance and monitoring performance of the treatment systems). The technical assistance unit of the external partner could help to build capacity in these areas before transferring operational responsibility.

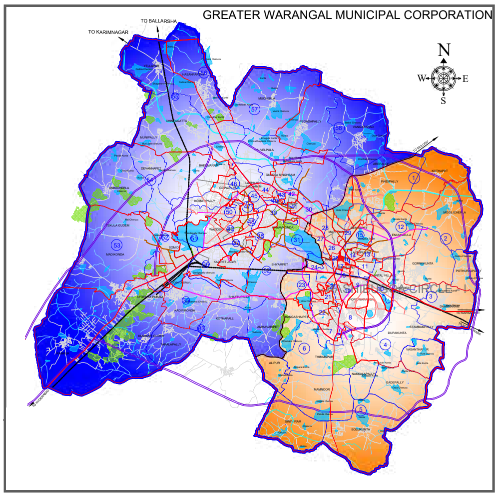
[11] Based on conversation with the Pourashava officials. They are looking for additional funding for furthering the FSM services, maintenance and performance of the treatment plant, and also looking into reuse options.

[12] Conversation with Vacutug operator.

4. Warangal, India

4.1. CONTEXT

Warangal city is the second largest city in the newly formed state of Telangana, India with a population of 810,000 (2011)[13]. It is the first city in India to introduce and implement Faecal Sludge Management (FSM) regulations. It was declared Open Defecation Free (ODF) in 2017 and achieved ODF ++[14] status in January 2019. Sanitation coverage is 94% (158,384 out of 167,636 households have toilets).[15]



MAP 3: Greater Warangal Muncipal Corporation, India

4.2. INITIATION AND PLANNING PROCESS

Building on an existing partnership through the Swacch Bharat Mission (SBM), the Greater Warangal Municipal Corporation (GWMC) and the Administrative Staff College of India (ASCI) conducted a detailed diagnostic study in 2015 to understand the status of faecal sludge management (FSM) in Warangal and prepare a comprehensive plan for enhanced sanitation by engaging the private sector with support from a Bill and Melinda Gates Foundation (BMGF) and UK Department for International Development (DFID) partnership. The findings revealed low service levels, evidence of open defecation, lack of adequate and inclusive toilets and no regulatory guidelines for the disposal and management of septage. Septage was disposed of in fields or outfall drains (V. S. Chary, 2017). Interviews and discussions with FSM operators, functionaries of GWMC and other stakeholders were also carried out during 2015-16 (V. S. Chary, 2017) and further information was gained through a Shit Flow Diagram (SFD) in 2017[16]. According to the Warangal SFD, 42% of waste is being safely disposed of or reused leaving 58% of waste which is not being treated. By this

[13] 2011 census population of all merged 42 villages is added to core city, CSP, GWMC, 2011, pp19

[14] A city / ward / work circle can be notified/ declared as SBM ODF++ if, at any point of the day, not a single person is found defecating and/ or urinating in the open, all community and public toilets are functional and well maintained, and faecal sludge/ septage and sewage is safely managed and treated, with no discharging and/or dumping of untreated faecal sludge/septage and sewage in drains, water bodies or open areas.

[15] Source: (GWMC, 2018)

[16] See Annexure 3: Shit Flow Diagram of Warangal, India

point, there was no open defecation within the city due to intense intervention through the SBM specifically focusing on toilets, hygiene and handwashing.

The results of the studies were disseminated widely amongst multiple stakeholders at city and state level though workshops and training programs for elected representatives, senior officials and through consultations with citizen groups. This evidence was the trigger that led to a consensus on the need for proper treatment of faecal sludge.

Extensive consultations and dialogues with stakeholders, to understand their concerns and involve them from the very beginning, were key in garnering support and ownership. This included civil society, Resident Welfare Association (RWAs), City Sanitation Task force (CSTF) members, Town Level Federation (TLF) members, non-governmental and private sector players including operators.

Elements considered in planning were:

- Aspirational technologies, leadership keen on innovation suitable to local conditions
- Availability of land
- Compliant with the environmental norms as per the relevant legislations

The technology choice was driven by Knowledge Partner ASCI and was part of larger project goals wherein BMGF in collaboration with the private sector is working on establishing a prototype business model using pyrolysis based plants.

4.3. INSTITUTIONAL SET UP

In 2015, ASCI set up a small Technical Services Unit (TSU) for implementing “City Wide Delivery of Sustainable and Equitable Sanitation Services in Warangal” with the support of the BMGF-DFID partnership. Initially the focus of the TSU was to aid the city on individual household latrine implementation as part of SBM. Under this same project a state level Project Management Unit (PMU) and city level Project Implementation Unit (PIU) were also set up within GWMC in 2017.

A non-sewer sanitation (NSS) cell was established in 2018 at the state-level to manage and operationalise NSS in 72 cities. Responsibilities of this cell include marking progress of ODF, sustaining of ODF, conversion of insanitary toilets to sanitary ones, scheduled desludging, waste management and monitoring FSM. A NSS cell was also established at the city level, within GWMC. Additionally a City Sanitation Task Force comprising multiple stakeholders including civil society groups was established by the GWMC for dialogue and participation.[17]

Also, in 2018, a Sanitation Innovation Hub was approved by the GWMC. The aim of the Hub is to promote innovation, test new technologies, encourage collaboration and thus develop an ecosystem of innovation and private sector players in the non-networked sanitation sector. Initial seed capital was committed by the state and city. Land was also identified for the purpose.

[17] City Sanitation Plan. GWMC,2018

4.4. INTERVENTIONS AND TECHNOLOGY

Capture and containment

The following interventions were carried out to improve design, construction and adoption of sanitary latrines and septic tanks:

- Adopting regulations on septic tank designs and construction methods as part of building plan regulations
- Conversion of unsanitary latrines into sanitary latrines leading to safe containment
- Training of masons for toilet/septic tank construction organised by GWMC to explain the approved standards and procedures for pumping and desludging and the use of personal protective equipment (PPE). Trained masons receive licenses and their details are shared with citizens.
- A helpline integrated into GWMC systems aided queries about implementation of new toilets, desludging and complaints and also provided technical assistance.

Emptying and Transportation

As part of the conversion to sanitary latrines, periodic desludging was introduced leading to safe management of faecal sludge. An advertisement campaign was run to promote FSM, which has also propagated to other cities of the state.

GWMC established a formal process for licensing of desludging operators and issued licences for collection and transportation operations since October 2016. The license is valid for five years and needs to be renewed every year. While the GWMC reserves the right to regulate and fix the user charges, it decided to let the process be market determined. Currently, an operator charges anywhere between USD 29 to USD 44 per visit (FSM 4 Case studies, 2017). The licenced desludging operators have trucks that meet the approved standards for desludging and transportation and are fitted with a Global Position System (GPS) by the operators at a cost of USD 120 per truck. The data is tracked by GWMC for monitoring using an app (V. S. Chary, 2017). They have trained workers equipped with uniforms, safety gear, tools and vacuum trucks.

GWMC is building a database of septage generation, insanitary latrines, location of septic tanks, details of operators responsible for collection of sludge, and details of the septage treatment plant. Detailed records of the operations, including households, area and location, type of septic tank, age of septic tank, date of desludging, quantity of septage, user charges collected, accidents and spillages, and the next date of scheduling for desludging are being kept. A system linking information gathered through the mobile app to the city's property database is being developed to ensure effective scheduling of desludging.

WaterAid/ Sujaya Rathi

FIGURE 3: Geobags, Greater Warangal Municipal Corporation, Telangana, India

Treatment disposal and reuse

GWMC with the help of BMGF has installed two different treatment plants on land provided by GWMC:

1. Geobags (Figure 3) with a 10 kilolitres/day treatment capacity (Banka BioLoo). This non-mechanical technology is used to dry faecal sludge from the onsite sewerage system and is suitable for decentralised faecal sludge treatment. Faecal sludge is transferred to these geo tubes/bags from the tankers and filtered and thereby dewatered. The effluent from the geobags is collected through drains and sent for treatment in STP. After few days when the capacity of the geo bag is reached, the sludge is taken out and is finally disposed of in a trenching site.
2. A thermal treatment plant with a 15 kilolitres/day treatment capacity (Tide Technocrats). Here sludge is treated by anaerobic stabilisation and then dried on unplanted drying beds. The liquid fraction is treated by DEWATS, using settler, anaerobic filters and constructed wetlands.

The by-products of these technologies such as bio solids can be reused in agriculture as soil conditioners and treated water can be used for irrigation or safely disposed into nearby water bodies. These disposal options are approved by the Government of India as well as the State Pollution Control Board. Daily monitoring of the performance of these systems is in place to optimise their operation.

4.5. FINANCIAL AND BUSINESS MODEL

The treatment plant is operating under the BMGF grant and there is no current business model in use. Based on learning from the private operators a business model has been developed to scale up at city and state level in order to encourage innovative technologies and private sector players in the sector.

In terms of operation and maintenance, the municipality has proposed the Hybrid Annuity Model (HAM). As per this model, 40% of the capital cost would be paid on completion of construction while the remaining 60% of the cost (raised through debt & equity investments) will be paid over the life of the project (12+ years) as annuities along with operation and maintenance (O&M) costs. One of the most important features of this model is that both the Annuity and O&M payments are linked to the performance of the FSTP. This will ensure continued performance of the assets created due to better accountability, ownership and optimal performance.

4.6. SUCCESSES AND LESSONS LEARNT

Warangal's inclusive approach (S line, SHE Toilets[18], worker safety program) and promotion of aspirational technology as well as the other successes listed below, have informed several state level policies and directives that contribute to an enabling environment for FSM throughout the state of Telangana and in other states:

1. Inclusion of FSM projects in Smart City Scheme[19] across the state.
2. A State Level Policy on FSSM has been released by the Government of Telangana in 2018 as well as a Request for Proposals for FSTPs in 72 more urban areas.
3. Directives to the cities have been issued in order to scale up building of FSTPs based on learnings from Warangal.

Evidence based advocacy: Compelling evidence, gathered through the diagnostic study and SFD and disseminated widely, helped to build public consensus on the importance and urgency of FSM services.

Committed leadership at state and city level: The leadership recognised the need and urgency for addressing unregulated septage management practices which drove the project forward. The NSS cell created an organisational structure and ensured that all staff knew their responsibilities linked to FSM.

Active dialogues and consultations: Involving different stakeholders led to ownership of FSM initiatives and acceptance of new practices. This also led to active support of desludging operators, who welcomed regulations and requested city government to prioritise faecal sludge treatment plants, and also were at the forefront in tariff discussions. Introduction to national and international good practices through exposure visits led to confidence building amongst this group.

Regulations: Recognising the importance of safe FSM, the GWMC took a lead in developing a regulatory framework covering the entire sanitation value chain in 2016[20]. The aim of the regulations and guidelines was to promote a

[18] Initiative by GWMC – public toilets specially designed to cater to needs of women with a woman caretaker

[19] National government scheme for some selected cities in India

[20] The Ministry of Housing and Urban Affairs brought out an advisory note and primer on FSM and septage management in urban India in 2013 and in 2016, and encouraged urban local bodies to formulate their own by-laws and rules for management of septage in the city.

comprehensive and integrated approach to FSM and septage management covering collection, storage, desludging, transportation, treatment, disposal and reuse. This initiative was not driven by the state but by the city. GWMC formalised FSM regulations and supporting operative guidelines by issuing a council resolution on 25th March 2016, making Warangal the first city in India to introduce a comprehensive FSM regulatory framework. FSM regulations and operational guidelines then formed the backbone of all FSM interventions.

Strengthening data systems at municipal level: Strengthening IT enabled data systems within the NSS cell enabled effective planning and the introduction of scheduled desludging of toilets.

Scope for scaling up: Based on performance of existing two FSTPs, the city has committed to scaling up the treatment plant to a capacity of 150 kilolitres/day[21]. Land has already been identified for this.

4.7. GAPS AND CHALLENGES

Technology selection: The technology selection process and allocation of land should have been done earlier in the process, in tandem with other interventions in the project cycle, to ensure desludging operators have a designated place for disposal and treatment. Otherwise, unregulated disposal continues and change is not observed by the citizens (V. S. Chary, 2017).

FSTP Location: The FSTP is located 20 km beyond city limits. Suitable land parcel/s closer to the market are likely to enhance compliance and the financial viability of the initiative.

Private sector ecosystem: There is a lack of committed technology providers with solutions that cover design, build, maintain and transfer.

Financial sustainability: There is a lack of clarity on the financial model for the plant including how to finance O&M. The biochar produced by the thermal plant is ready to be used in agriculture but there is currently no business model to sell it.

[21] Source: Discussion with Dr. Chary- director of ASCI

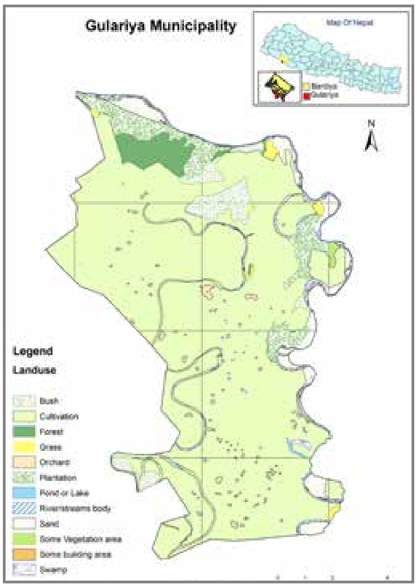
5. Gulariya, Nepal

5.1. CONTEXT

Gulariya Municipality is located in the plains of the Terai region near the southern border with India in mid-western Nepal. Gulariya became a municipality in 1995 and was restructured in 2015. The population of the municipality is 66,679 in 12 wards with a population density of 564 per km^2 (Census, 2011). The municipality was declared an Open Defecation Free Zone in April 2014. Currently, it offers mechanised emptying, transportation and treatment facilities. In a 2017 study, it was found that 88% of households used pour flush toilets with a single pit and 9% used pour flush toilets with a septic tank (ENPHO, WAN, 2017). A Faecal Sludge Treatment Plant (FSTP) was constructed in 2016 as a post ODF initiative in the region with an aim to sustain ODF status and as part of a technology demonstration project.

5.2. INITIATION AND PLANNING PROCESS

The first initiative to address FSM was a partnership between Practical Action and the Environment and Public Health



MAP 4: Gulariya Muncipality, Nepal

Organisation (ENPHO) in the SAFA and SWASTHA Gulariya Project in 2014[22]. The objective was to pilot innovative solutions in sanitation to improve disaster resilient sanitation facilities and faecal sludge management. Management of faecal sludge was a major issue raised by communities during the ODF campaign, but at that time, promotion and construction of toilets (mostly pit toilets with 3-5 concrete rings) and achieving ODF status gained priority. The average volume of the pit toilets in the town was 1,000 litres and thus by 2016 most of them needed to be emptied.

[22] Implemented By: Practical Action; Funding: European Union, UN-Habitat Water and Isle of Man Government; Partners: Environment and Public Health Organization (ENPHO), Municipal Association of Nepal (MuAN), Gulariya Municipality

The resulting demand from communities triggered the construction of a faecal sludge treatment plant as a demonstration pilot project. Concurrently, the municipality were discussing development of a landfill site and experts recommended that both liquid and solid waste treatment could be combined in a common site with the aim of producing compost from faecal sludge and solid waste.

The municipality organised the land for the treatment plant though a partnership between the municipality, project and Sarju Community Forest Users Group (SCFUG) who agreed to provide land for the plant in the community forest. An agreement was drawn up which detailed involvement of the group in managing the plant as well as receiving some profits from the sale of end products. The municipality agreed also to invest in forest conservation, bought a desludging truck, while the capital cost of the FSTP was assumed by Practical Action (a project partner), ENPHO assisted with technical support. The focus was on implementation as a showcase project, not as a sustained service delivery mechanism and so no formal planning process was followed.

The treatment plant was a new initiative in the region and hence stakeholders were not confident about the effectiveness and reliability of the technology. The SAFA and SWASTHA Gulariya project arranged a learning visit, on the effectiveness of constructed wetland and sludge drying beds, to the Decentralised Wastewater Treatment Plant in Dhulikhel.

The proposed construction details of the FSTP were presented, discussed and approved in a stakeholder meeting and it was then incorporated in the annual plan of the municipality for the fiscal year 2015-16 and approved by the municipal assembly.

5.3. INSTITUTIONAL SET UP

The Project Management Committee (PMC) was formed with responsibility to oversee and guide project implementation and enhance ownership of the initiatives to improve long-term sustainability and continuity of activities.

The treatment plant was constructed in the Sarju Community Forest with the help of a local contractor and technical supervision from ENPHO technical staff, in coordination with Sarju Community Forest Users Group. The monitoring of the construction, to ensure high quality and timely completion, transparency and progress, was achieved through progress reporting to the PMC.

Although the plant is managed by SCFUG, the Municipality oversees operation and maintenance, responsible for carrying out daily O&M of both the solid waste treatment unit and the faecal sludge treatment unit (both on the same site). This was due to a lack of interest from members of SCFUG. The supervisor was appointed from the Sarju Community Forest User Groups as part of the informal commitment made by the municipality.

Design Consideration and Size	
Design capacity	3 cum. per day
TSS loading	200 kg TS/sqm./year
Sludge strength	2500 mg/l
Modules Adopted	
1) Sludge Drying Beds	**7 Beds**
Surface Area	21 sqm. each (3m x 7m)
Filter Media	Coarse sand (depth 0.5m)
2) Settler + ABR	**1 Unit**
Wastewater flow	3.7 cum./day
Volume of settler	3.7 cum. (1.7m x 1.2m x 1.6m)
Influent/Effluent quality	BOD: 750 / 555 mg/l
Volume of ABR	4.6 cum.
Water Depth	1.60 m
Influent/Effluent quality	BOD: 555 / 162 mg/l
3) Planted Gravel Filter	**1 Bed**
Surface Area	28 sqm. (4m x 7m)
Depth	0.5 m
Filter Media	River Gravel
Effluent quality	BOD: 50 mg/l

FIGURE 4: FSTP Design, Gulariya Municipality, Nepal

5.4. INTERVENTIONS AND TECHNOLOGY

Emptying and Transportation

A locally improvised mechanised desludging transport vehicle was developed to ensure collection in less accessible areas. However it proved inefficient at pumping out thick sludge from pits and inconvenient for longer distances. Thus, the municipality allocated budget in its annual fiscal plan for the year 2015-16 and approved the purchase of a fully mechanised suction vehicle for desludging services. Despite this, low-income households still practice traditional manual emptying and dumping and/or use the improvised mechanised desludging transport vehicle.

The municipality is responsible for the collection of solid waste and transportation and desludging of faecal sludge on demand. The municipality has implemented a service fee and records the deployment of the desludging vehicle. However, it seems that there is not yet a process to analyse and use that information to make improvements (for example, scheduled emptying). Latest records[23] show that demand for the services remain low (7 trips/month) and restricted to the core urban cluster (70% from core area), and that areas beyond the core urban cluster lacked information on the municipal service.

[23] 2018/5/20 to 2018/11/15

WaterAid/ Sujaya Rathi

FIGURE 5: Faecal Sludge Treatment Plant- Gulariya, Nepal

Treatment

The characteristics and volume of faecal sludge that would be transported to the FSTP was estimated based on total households in the municipality and the assumption that more than 75% of the households have offsite pits constructed with an average of 5 concrete rings. The components were determined based on use of end product as organic fertilizer with prioritisation of lower operational and maintenance costs. The choice was also based on a technology that was already established in the region (DEWATS). The design considerations and features of the FSTP is given in Figure 4. The sludge drying bed (SDB), anaerobic baffled reactor (ABR) and horizontal flow constructed wetland are in good condition (Figure 5). However, a flood in the initial year of operation has clogged the filter media and lack of technical knowledge on O&M means that this has increased the duration of sludge drying as the efficiency of horizontal flow constructed wetland has reduced.

Reuse

The FSTP was designed to produce organic fertilizer from dried sludge and generate some revenue through the sale of it. However, there has not been laboratory testing of the quality of the dried sludge or assessment of the potential market. The excavated dried sludge was applied within the site, and anecdotal evidence claims good results and potential for agricultural use. However, there is no scientific evidence to prove that the dried sludge is safe and nutrient high.

5.5. FINANCIAL AND BUSINESS MODEL

A draft business plan was developed by the project to ensure cost recovery for O&M of the system and it estimated a net profit to be generated through desludging services and selling of organic fertilizer. However, the revenue generated is lower than the estimate due to higher labour cost (more staff employed than estimated), low desludging demand, and the fact that no organic fertilizer has been produced.

5.6. SUCCESSES AND LESSONS LEARNT

Partnership: A partnership between municipality, project and Community Forest Users Group (CFUG) based on a benefit sharing model was key to ensuring the projects success.

Scope for scaling up: The municipality has developed a partnership with the WASH Finance Project[24] with the aim of scaling up services in the city through social mobilisation for creation of demand, developing a Standard Operating Procedure (SOP) for SWM and FSM, reviewing the draft business plan and adding necessary improvements to develop sustainable plans to operate integrated FSM and SWM.

5.7. GAPS AND CHALLENGES

Demand: The demand for FSM services is limited and even where it exists, accessibility of the faecal sludge truck to many areas remains an issue, leading to unsafe disposal of sludge. The impact of the floods on the efficiency of the functioning of the FSTP, deterred efforts towards advertising its service. Currently due to low sludge collection, the total capacity of plant is not utilised.

Design of the FSTP: The FSTP was not contextualised during design to take into account the flood risk in the area. Also, the total population and its service area has increased from 2015 to 2018, from 7,500 households to 13,000 households. The FSTP was designed for 7,500 households. Design should take into account future growth where possible.

Reuse: If co-composting is to be done, the compost site needs to be redesigned with a segregation mechanism established and more training must be done with staff. Quality assurance processes must be in place to assure the safety of the end product. Also, there is currently no market for revenue creation from dried sludge.

Institutional capacity building: The need for improved skills and for standard operating procedures for SWM and FSM services have been realised by the municipality. Technical assistance from ENPHO helped the municipality to build the plant but transfer of knowledge was inadequate (only basic training was provided).

[24] WASH-FIN is a five-year program financed by the United States Agency for International Development (USAID) implemented by TetraTech

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7. Annexures

7.1. ANNEXURE 1: Sakhipur SFD (pre and post intervention)

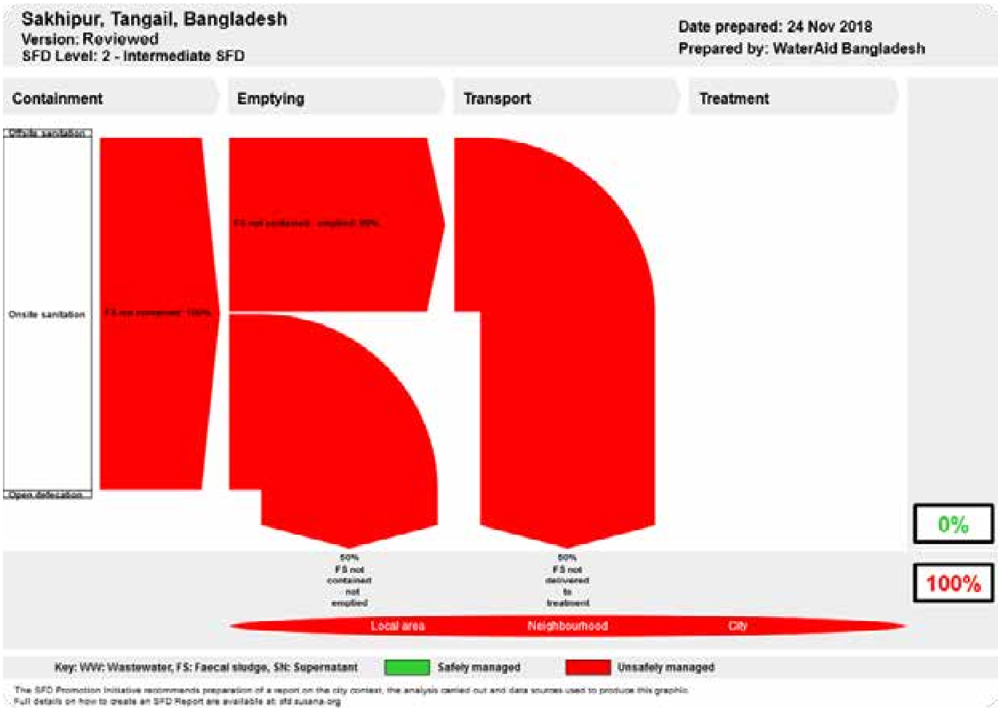


Figure: Excreta Flow Diagram of Pre-Condition of Co-Composting in Sakhipur

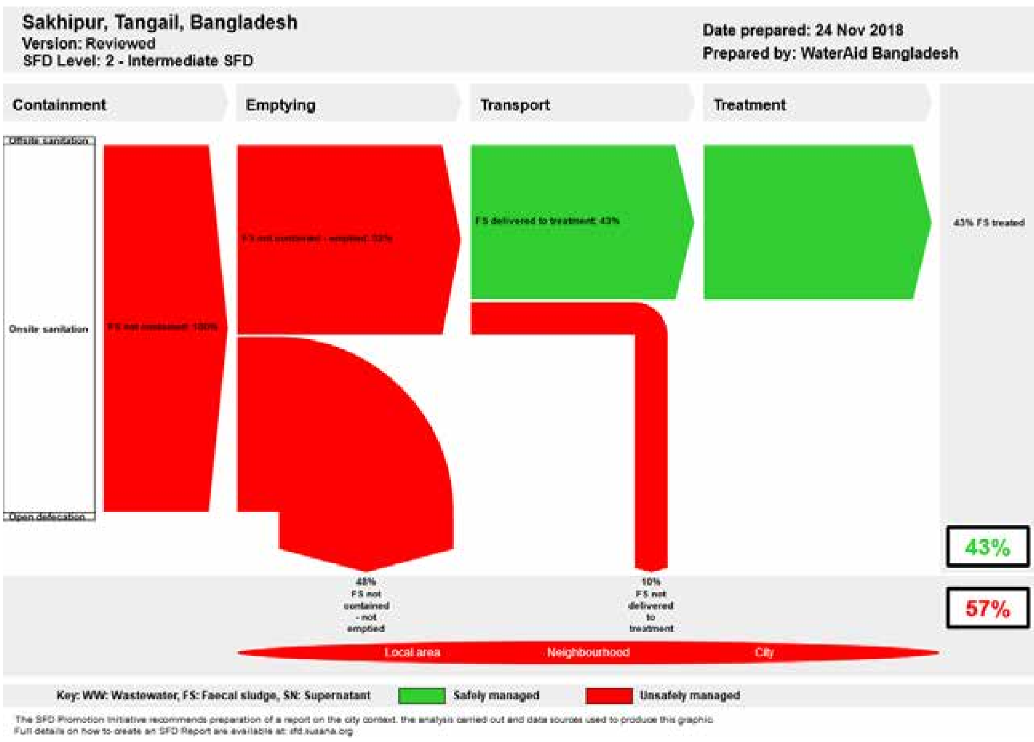


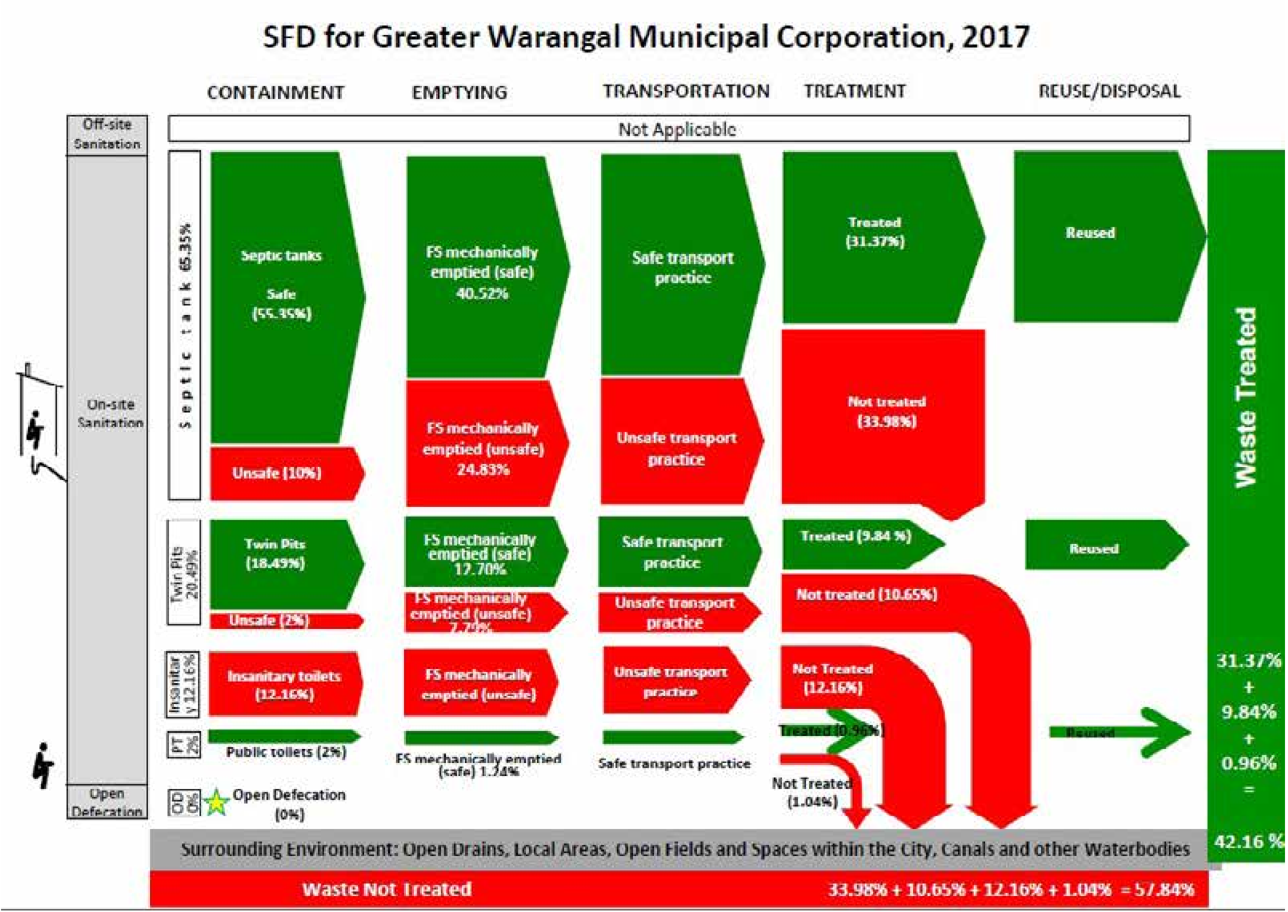
Figure: Excreta Flow Diagram of Post-Condition of Co-Composting in Sakhipur

7.2. ANNEXURE 2: Willingness to pay for better faecal sludge management service

During the baseline survey, households were asked to give suggestions to improve the faecal sludge management situation in the municipality and their willingness to pay for faecal sludge management services. About 40% of the respondents were willing to pay between 1-200 BDT per month for desludging services. Majority of the respondents had no suggestion or idea to improve the current practice and situation of faecal sludge management in the municipality. Only few respondents provided suggestions for improvements like using vacuum tanker, using compost plant or transfer to other location for treatment and disposal, etc.

Willingness to pay per month (Tk.)	Frequency	Percentage
Nil	165	61.11
1.0	7	2.59
2.0	9	3.33
3.0	2	0.74
5.0	1	0.37
10.0	11	4.07
15.0	5	1.85
20.0	24	8.89
25.0	3	1.11
30.0	15	5.56
35.0	2	0.74
40.0	3	1.11
50.0	13	4.81
100.0	6	2.22
150.0	2	0.74
200.0	2	0.74
Total	**270**	**100**

7.3. ANNEXURE 3: Shit Flow Diagram of Warangal, India



7.4. ANNEXURE 4: Stakeholder Consultation – Bangladesh

1.a. Lakshmipur, Bangladesh

Name	Organisation
Alhaz M. A. Tarek	Lakhsmipur Pourashava
Md. Rafiqul Islam	Lakhsmipur Pourashava
Councillor 1	Lakhsmipur Pourashava
Councillor 2	Lakhsmipur Pourashava
Md. Nasrullah	DPHE, Lakhsmipur
Md. Nasir Uddin	DPHE, Lakhsmipur
AKM Muktadir Rahman	Lakhsmipur Pourashava
A.K.M Shaheed Uddin	Lakhsmipur Pourashava
Nur Karim Suman	Lakhsmipur Pourashava
Abul Hossain	Lakhsmipur Pourashava
Md. Mirzu	Lakhsmipur Pourashava
Kamal Uddin	Lakhsmipur Paurashava

1.b. Sakhipur, Bangladesh

Name	Organisation
Md. Khairul Islam	WaterAid Bangladesh
Dr. Md. Liakath Ali	WaterAid Bangladesh
Jaison Thomas	WaterAid South Asia
Suman Kanti Nath	WaterAid Bangladesh
Md. Samiul Basar	WaterAid Bangladesh
Fariha Rahman	WaterAid Bangladesh
Rajeev Munankami	SNV Netherlands
Md. Azizur Rahman	ITN-BUET
Ashish Barua	Oxfam International
Tanveer Ahsan	DevCon
Engr. M Omar Faruq	Faruq Fertilizers Limited
Alok Mazumdar	SIMAVI
Sujaya Rathi	WaterAid - Consultant

Bangladesh: consultation notes from Sakhipur stakholder meeting

A Stakeholder Consultation Meeting as part of the multi-country study on FSM Landscape in South Asia was held on 1 November, 2018 at the Royal Park Residence Hotel, Banani, Dhaka. The key objective of this consultation was to get to know the various factors that have contributed to the enabling enviornment for FSM in Bangladesh. There was general consensus that the political commitment was the key driving force. The example shared was that of Sakhipur co-compost plant, which came out of a partnership between Sakhipur Municipality, WaterAid and BASA. Followng a visit to the plant from Prime Minister's office, there is keen interest at highest political level to replicate similar intervention in other cities. Participants shared other initiatives in this direction such us publication and dissemination of IRF-FSM, working committee for developing a national action plan to implement the framework and WASH Focus Group in the Parliament. WaterAid has been advocating to include FSM as part of the commiments of political parties in the upcoming elections. One of participants commented that that there are currently many evidences to build the confidence among the political leaders on FSM. But push from both the government and private sector is necessary.

Around the institutional responsibility, the participants shared that while IRF-FSM provides clear mandates, there is still lot more work needed to roll it out effectively. Sector has a key role to support this process, particularly in addressing challenges in translating the framework into practice. IRF is not a legal document and there is need for coordination between various agencies like city corporations, WASAs and Pourashavas to implement it. There are also capacity gaps that need to be addressed. Also, there exists some complexities in official positions of different agencies.

About planning framework, it was commented that most of the consultants are technology biased, but there are not many examples of technology used in Bangladesh. Decentralised planning is prepared in every sector, but FSM issue is not prioritised as such and there is unwillingness on part of officials/engineers to work in sanitation sector. IRF allocates most of the responsibilities to LGIs, which can be implemented through various agencies. There was a concern that often municipalities focus on the infrastructure rather than sustainable service delivery. They wait for another grant to maintain the FSTPs. It is also a fact that they are not generating sufficient revenue to sustain the FSM services. However, there is potential for them to work with NGOs and other develoment agencies to help implement sustainable FSM services.

Participants recognised that capacity building is a huge need. There is currently a grant from Bill and Melinda Gates Foundation to ITN-BUET on national capacity building. DPHE and DWASA are also coming forward to build capacity. But training, skill development, human resources all are part of capacity building which needs proper assessment and operational plan. Stakeholders consultation need to be conducted considering the value chain. There are some good practices, from which best examples for different parts of the value chain can be taken. One participant commented that influx of huge capital cannot guarantee successful intervention unless accompanied by building capacity.

On involvement of private sector and their challenges, it was mainly limited to informal emptiers. SNV arranged two national conventions for the sludge emptiers. The challenges are that the emptiers are not so much interested in doing such kind of jobs and also they do not want their next generations to be involved in this business. Another comment was that the municipality can dispose of the sludge to the private sector, who can use it as raw material for fertilizer. It was shared that multilateral foundations do not invest separately for FSM, rather those are components of some big projects. If good interventions can be showed, positive perception both from the lenders and general people can be built.

Moving forward for a successful FSM system, all components need to be covered. Technological, civil construction and social considerations should be integrated. Planning should be done considering the whole value chain. Mapping and enforcement should be done by the municipality for scheduled desludging. It was commented that construction of the plant or the creation of demand, which should be done first continues to be an issue where there is no clear consensus.

On technical aspects, it was commented that Department of Environment (DoE) does not have any standards for faecal sludge, although they are coming forward for the standardisation. FSM Network is also advocating DoE for the standardisation. WaterAid shared that getting certificate for the co-compost from Department of Agricultureal extension has been a long process. EUWAG is collecting data and and conducting study on technology choice. There is a need of capacity for monitoring different parameters, particularly around treatment and end use products. Bangladesh Agricultural University has a full-fledged laboratory to test faecal sludge and ICDDRB can test the pathogens.

However, more such facilities are needed. It was shared that unversities can support this and college students could be trained on FSM. Overall, it was felt that both both the government and major multilateral agencies, along with private sector should come forward to scale up FSM. Civil society organisations along with communities can play a supportive role.

WaterAid Bangladesh

Participants in Stakeholder Consultation Meeting

Some key takeaways and recommendations were identified at the end of the meeting:

- Political commitment is a key driving force and needs to be ensured
- IRF-FSM provides a good framework to start with
- Community involvement and mobilisation
- Consider the whole sanitation value chain while planning
- Capacity building before any huge intervention
- Creating evidence based examples
- Involvment of private sector is important
- Safe disposal of sludge and innovative marketing of end products
- Innovative interventions should be within the thinking
- Ensuring quality throughout the sanitation value chain is important
- Eliminating superstitions on the usage of end product
- Involvement of academic institutions and training college students on FSM

7.5. ANNEXURE 5: Stakeholders Met – India and Nepal

1. India: stakeholder list

Name	Organisation
Dr. Srinivas Chary Vadela	ASCI
Dr. Malini Reddy	ASCI
Aparna	ASCI
Raj Mohan	ASCI
Abhishek	ASCI
Raja	MHO - Warangal
Amresh	Tide Technocrats
Technical person	Banka Bailoo
Sampath Rao	Truck Operator
Suresh	Digital engineer, PMU
Shrinu	Sanitary Inspector
Lakshmi	Caretaker, SHE toilet
Rohit Kakkar	CPHEEO
Akalli Muthu	WASH Institute

2. Nepal: stakeholder list (Gulariya Municipality)

Name	Organisation
Ram Chandra Poudyal	Chief Executive Officer
Mukunda Aryal	Senior Section Officer
Arjun Kumar Lamsal	Sub-engineer
Kapil Ghimire	Administrative Officer
Sahadev Yadav	Desludging Vehicle Driver
Ashok Rai	Firefighting Staff
Amber pariyar	Desludging labour
Guru Bachan B.K.	Desludging Operator
Hare Ram Bhurtel	FSTP Supervisior

A worker emptying sludge into the drying bed at Sakhipur co-compost plant, Tangail, Bangladesh
WaterAid/ Al-Emran

A study by the Urban Sanitation Working Group, South Asia Region, WaterAid | September 2019
Contact: Jaison Thomas at JaisonThomas@wateraid.org